Beiträge zur Kenntnis der Fauna von Süd-Afrika.

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IX. Freshwater Sponges.

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With 3 figs. in text.

The Sponges which Prof. WEBER has been kind enough to send me for examination belong to three well-defined species, two representing the genus *Spongilla* (sensu lato), the third *Ephydatia*. Owing to the kindness of Mr. R. KIRKPATRICK of the British Museum, and Dr. W. MICHAELSEN of the Hamburg Natural History Museum, I have been able to compare them with pieces of the types of most of the species as yet recorded from the continent of Africa, while the large collection of Asiatic and European Spongillinae in the Indian Museum has much facilitated my task.

Genus *Spongilla*, auctorum.

Subgenus *Spongilla* WIERZEJSKI.

Spongilla ambigua n. sp.

Sponge consisting of a delicate film occurring in small patches on solid objects; the surface apparently irregular and minutely

hispid, the oscula and pores minute; subdermal space (?) small (membrane mostly destroyed in the type); colour (in alcohol) dirty white. Skeleton feebly coherent, with small, irregular, triangular meshes outlined for the most part by single spicules, with mere traces of fasciculation. Skeletons spicules (megascleres) numerous but not sufficiently so to make the sponge hard, smooth or slightly rough, sharply pointed, nearly straight, short, slender, about 24 times

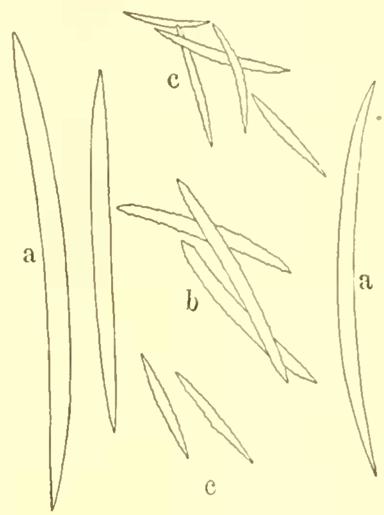


Fig. A.
Spicules of *S. ambigua*.
a Skeleton spicules. b Gemmule spicules. c Free microscleres.

as long as their greatest diameter (in the type specimens). Free microscleres sparsely scattered in the parenchyma, fairly numerous in the membrane, resembling gemmule spicules but smaller and rather finer. Gemmules small, subspherical, flattened at the base, by which they are firmly adherent to the support of the sponge, grouped together so as to form a pavement layer, each provided, immediately outside the chitinous coat, with a sparse layer of microscleres lying nearly parallel to it, outside this layer with a thick coat of relatively large, polygonal air-chambers arranged in several tiers, and outside this coat with a second layer of microscleres resembling the inner one; the single aperture terminal, provided with a broad, straight, vertical, cylindrical chitinous tube, which is patent above, does not project or projects very little beyond the air-chambers and is contracted at its base, its distal extremity being devoid of a thickened rim; the diameter of the gemmule very variable. Gemmule spicules straight or nearly so,

sharply pointed, irregularly spined in the middle but smooth at the ends.

Transverse diameter of gemmule	0.36 mm (average).
Skeleton spicules (megascleres)	0.2664 × 0.012 mm (average).
Gemmule spicules (microscleres)	0.12 × 0.008 mm (average).
Free spicules (microscleres)	0.08 × 0.006—0.06 × 0.003 mm.

Habitat. River Umhloti, near Verulam, Natal, S. Africa; on stones. M. Weber, leg., Nov., 1904.

This sponge exhibits close affinities, especially in the structure of its gemmules, to the group represented by *S. carteri* Bowerbank, and *S. nitens* Carter, and by several other African species. Apart from differences in the spicules and skeleton, however, it differs from all the species of this group in that its gemmules are adherent and grouped, in this character agreeing with the species of the subgenus *Spongilla*, of which *S. fragilis* Leidy, is the type. I am therefore inclined to think that this subgenus should be regarded as including all the species of *Spongilla* (sensu lato) the gemmules of which bear a coat of relatively large, polygonal air-chambers, and should not be confined to those in which the gemmules are grouped. In *S. fragilis*, *S. crassissima* mihi, and other allied species the gemmules exist both as free groups and as a pavement layer; but in *S. ambigua* the sponge forms too thin a film to contain free groups of gemmules, and the gemmules are therefore adherent, being formed at the base of the sponge in contact with its support.

Subgenus *Stratospongilla n. subg.*

Gemmules covered with one layer or two or more layers of microscleres lying parallel or nearly parallel to the chitinous coat and embedded in a dense chitinoid substance. No air-chambers; granular layer absent or imperfectly developed. Free spicules, when present, amphioxous or amphistrongylous.

Type *Spongilla bombayensis* Carter.

Spongilla bombayensis Carter.

Carter in describing this species had in his possession only a few gemmules with the spicules that adhered to them. His

description is not only incomplete but actually misleading, owing to this paucity of material, and I therefore take the opportunity to publish a more detailed account of a form which runs a considerable risk of being described as a new species, seeing that it occurs both in Asia and Africa. I have had before me in drawing up this new description several of the original gemmules, a number of specimens obtained by myself in a lake in the Bombay Presidency, and also a considerable amount of material collected by Prof. Weber in Natal.

Spongilla bombayensis may be described as follows:

Sponge forming a rather thin layer on solid objects; its surface irregular; the oscula and pores inconspicuous; the subdermal space small. The skeleton, owing to the large number of spicules, compact, but incoherent and almost amorphous; vertical spicule-fibres present

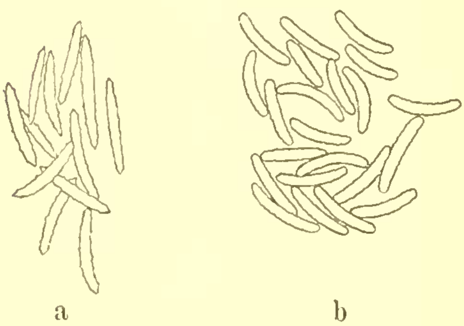


Fig. B.
Gemmule spicules of *S. bombayensis*.
a From type specimens (Bombay).
b From specimen from Natal.

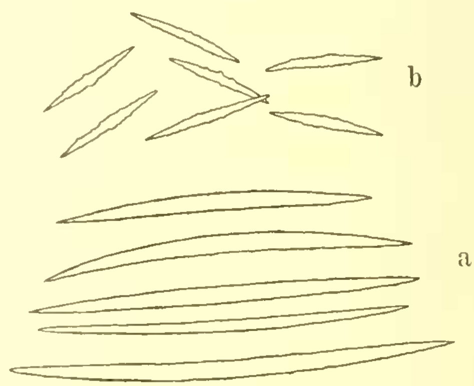


Fig. C.
Spicules of *S. bombayensis* from Natal.
a Skeleton spicules.
b Free microscleres.

in places but practically devoid of spongin; a more or less definite reticulation of horizontal spicules lying immediately under the membrane, which they rarely penetrate. Skeleton spicules (megascleres) slender, short, amphioxous, smooth, slightly roughened, or irregularly and very minutely spined, straight or feebly curved. Free spicules (microscleres) slender, short, sharply amphioxous, straight or nearly so, irregularly roughened or minutely spined all over the surface, scanty in the parenchyma, abundant in the membrane. Gemmule spicules short and rather stout, very variable in proportions, abruptly pointed or amphistrongylous, sometimes inflated in the middle, irregularly roughened or minutely spined all over. Gemmules very variable in size, round or oval, generally flattened at the base, firmly adherent

to the support of the sponge by means of the outer chitinous layer, distinct from one another, with one aperture or with several; the aperture or apertures at the side of the gemmule in its natural position; foraminal tubule or tubules short and straight or long and curved, sometimes bending down in such a way that their distal aperture is in contact with the support of the sponge; the gemmule spicules separated into two layers by an empty space; the inner layer one spicule thick, lying in close contact with the inner chitinous coat of the gemmule, to which it is parallel; the outer layer sometimes several spicules thick, parallel to the inner one, its spicules fastened together in an outer chitinous coat in which dark granules are sometimes present.

Localities. India: Bombay town (CARTER); Igatpuri Lake, Western Ghats, Bombay Presidency (ANNANDALE). Africa: R. Umhloti, near Verulam, Natal (WEBER).

The differences between the Indian and the African examples of the species are of no great importance, being slighter than those frequently found, in some species, in sponges from different ponds in the same locality. The most definite of them is that the gemmule spicules are as a rule blunter and larger in the Natal specimens: but even this is not a constant character. The following measurements are derived from an examination of the spicules of several sponges from India as well as the type specimen and of several of Prof. WEBER's specimens from S. Africa:

	S. Africa	Bombay Presidency
Free spicules	0,068 × 0,0035 mm	0,06 × 0,0025 mm
Skeleton spicules	0,228 × 0.012 0,2 × 0,006	0,334 × 0,0075
Gemmule spicules	0,08 × 0,006 0,028 × 0,004	0,0346 × 0.008 0,044 × 0,0046

Spongilla bombayensis is closely allied to three other species found in Africa and Asia, namely *S. rousseletii* KIRKPATRICK [1]), *S. sumatrana* WEBER [2]), and *S. indica* ANNANDALE. [3]) In *S. rousseletii*, however, the gemmules do not appear to be adherent and there are no free

1) In: Proc. zool. Soc. London, 1906, Vol. 1, p. 223.
2) In: Zool. Ergebn. Niederl. Ost-Indien, Vol. 1, p. 38.
3) In: Rec. Ind. Mus., Vol. 2, p. 25.

spicules — the latter perhaps not a very importance difference; while in *S. sumatrana* and *S. indica* there is only one layer of spicules on the gemmule. *S. navicella* Carter, from the Amazons, seems also to be an allied form, but is distinguished by the shape of its gemmule spicules, especially those nearest the gemmule; for the gemmule spicules are stated to differ in accordance with their position as regards the gemmule. A similar difference in the gemmule spicules of different layers was noticed by Carter in *S. bombayensis* and is easily detected in some gemmules. In others, however, it is not perceptible, and I believe that it is due to the fact that the outer spicules do not always reach the same perfection of development as those which are formed first and are therefore nearer the gemmule.

The specimens collected by Prof. Weber in Natal and those collected by myself in the Bombay Presidency were both obtained in the month of November. It is therefore very interesting to compare them from a biological point of view. In so doing it must be remembered that while in S. Africa November is near the beginning of summer, in India it is at the beginning of the "cold weather", that is to say both the coolest and the driest season of the year. The lake in which my specimens were obtained had, at the time when they were collected, already sunk some inches below its highest level, leaving bare a gently sloping bank of small stones. Adhering to the lower surface of these stones I found many small patches of *Spongilla bombayensis*, quite dry but complete so far as their harder parts were concerned and with the gemmules fully formed at their base. From the shallow water at the edge of the lake I took many similar stones which still remained submerged. It was evident that the sponge had been just as abundant on their lower surface as on that of the stones which were now dry; but only the gemmules remained, sometimes with a few skeleton spicules adhering to them. The bulk of the skeleton had fallen away and the parenchyma had wholly perished. In a few instances a small sponge, one or two millimetres in diameter, had already been formed among the gemmules; but these young sponges appeared to belong to some other species, possibly *Spongilla indica*, which was also common in the lake.

Carter's[1]) specimen of *S. bombayensis*, which was evidently in

1) In: Ann. Mag. nat. Hist. (5), Vol. 10, p. 369 (1882).

much the same condition as those I found still submerged a month later, was taken in October in a disused quarry. It was surrounded by a mass of *S. carteri* three inches in diameter, and was attached to a herbaceous annual. The point on the edge of the quarry at which this plant grew was not reached by the water until July. It is therefore necessary to assume that the gemmules of *S. bombayensis* had been formed between July and October. Probably the larva of the sponge had settled down on the plant during the "rains" — which commence in Bombay about the beginning of June — and had grown rapidly. The production of gemmules may have been brought about owing to the sponge being choked by the more vigorous growth of *S. carteri* [1]), a species which grows to a considerable size in a comparatively short time, while *S. bombayensis* apparently never reaches a thickness of more than a few millimetres.

In India the season of greatest vegetative activity in most freshwater sponges is the cold weather. *S. carteri*, the commonest species, as a rule dies down in spring, after producing both gonads and gemmules. The larvae settle and in some cases grow to a considerable size during the hot weather and the succeeding "rains". A very large proportion, however, appear to perish. The gemmules remain quiescent until the temperature sinks in October or November, and then sprout. It is rare to find gemmules in growing sponges of this species during the period between March and October. In September and October eggs are often produced. Gemmules are produced at all seasons by sponges actually undergoing desiccation, which occurs most commonly in December, January and February; in those sponges which remained submerged, gemmules as a rule commence to develop in February or March. Many other freshwater sponges (e. g., *S. alba*, *S. crassissima* and *Ephydatia meyeni*) have a similar annual history in the Calcutta "tanks" or ponds, but some small species (e. g., *S. proliferens*), the life of the individual sponge of which is very short, continue to produce gemmules throughout the year and apparently do not develop gonads, while others (e. g., *Trochospongilla latouchiana*) as a rule are found only during the "rains", apparently because they frequent positions near the surface

1) The largest specimen I have seen forms an irregular mass 30 cm long, 26 cm broad and about 28 cm deep; but this is perhaps the combined growth of several years.

of the water or the edge of the pond which are left dry early in the cold weather. It is probable that *S. bombayensis* resembles these last species in its habits. The manner in which its gemmules are fastened to the solid support of the sponge must be particularly useful in enabling them to sprout in a convenient environment as soon as the water reaches them. This is probably the case also as regards *S. sumatrana* and *S. indica*, although there is some evidence that the latter species flourishes in the cold weather rather than the "rains", and it is noteworthy that in all these three species the skeleton, although somewhat compact owing to the large number of spicules of which it is composed, is incoherent. The fact that the gemmules remain fixed without its support, renders it unnecessary for the skeleton to persist as a cage containing them (or at any rate a proportion of them) during the period of hibernation or aestivation as the case may be.

Prof. Weber's specimens of *S. bombayensis* were collected in a river, apparently on stones or rocks, towards the beginning of the S. African summer. They contain comparatively few gemmules and were evidently in a vigorous condition as regards vegetative growth. Unfortunately we know nothing of the seasonal changes which take place in freshwater sponges in S. Africa, but the general difference between these changes in Europe and in India shows that they are dependent on the environment as well as the idiosyncrasy of the species. It is very interesting, therefore, to see that the condition of sponges taken in S. Africa differs so widely from that of other individuals of the same species taken in India at the same season.

In Prof. Weber's specimens I have found numerous small tubules of inorganic debris. These appear to be the work of Chironomid larvae, of which there are several specimens loose in the bottle containing the sponges. Other tubules of a very similar appearance but with a delicate chitinoid foundation appear to be the remains of a species of *Plumatella* of which they occasionally contain a statoblast. The statoblasts are large, elongated and broadly rounded at the ends, the sides being parallel or nearly so. The swim-ring is very narrow, especially at the sides; the following are the measurements of one of the statoblasts: Length 0,4128 mm, breadth 0,2064 mm; length of central capsule 0.3268 mm, breadth of central capsule 0,1892 mm. I do not think it possible to identify the species of this genus by means of the statoblast alone, and all that can be said of the other characters of the form to which this particular

statoblast belongs is that the zooecia are narrow, delicate, encrusted with inorganic particles, not agglutinated together or rising from the support in a vertical position and parallel to one another, but apparently recumbent in the substance of the sponge. The species of *Plumatella* most commonly associated with sponges, both in Europe and India, is *P. fruticosa*, the "*coralloides*" phase of which appears to be specially adapted for this mode of life, its tubules growing outwards through the substance of the sponge in such a way that their distal extremities project from its surface. I do not think, however, that the *Plumatella* in Prof. Weber's specimens from the Cape belonged to this species, which is more often found associated with sponges of more vigorous growth such as *S. carteri* and *S. lacustris*. In specimens of an *Ephydatia* from Java, sent me by Prof. Weber, I found flourishing colonies of *P. javanica* Kraepelin — a species which also occurs in Calcutta — growing much in the same way as the one in the S. African sponge of the same genus must have done.

Genus ***Ephydatia*** Gray.

Ephydatia fluviatilis auctorum.

E. fluviatilis var. capensis Kirkpatrick, in: Ann. Mag. nat. Hist. (7), Vol. 20, p. 523, fig. 1—8 (1907).

Specimens obtained by Prof. Weber in the River Komenassie near Oudtshoorn, Cape Colony, should probably be assigned to Kirkpatrick's recently described variety. Variation, however, is so inconstant in this species that it is difficult to recognize "varieties". The majority of the birotulates in Prof. Weber's specimens have smooth shafts, but occasionally it is possible to find one in which the shaft bears one or two long, stout spines standing out at right angles to it. I have not seen a spicule, however, in which these spines are so numerous or so regularly arranged as in one of those figured by Kirkpatrick (op. cit., fig. 7). In Prof. Weber's specimens the skeleton spicules are smooth and the vesicular cells which form so conspicuous a feature of *Ephydatia mülleri* and its Indian representative *E. meyeni* Carter, are absent. The following are the measurements of the spicules in Prof. Weber's specimens:

Skeleton spicule	0,340 mm × 0,013 mm
Gemmule spicule (length)	0,024 mm
Diameter of rotule	0,018 mm

This appears to be the only freshwater sponge hitherto recorded from Africa south of the Zambesi. In Europe and N. America the species is one of the commonest, and it has also been recorded from Australia and the Malay Archipelago. Its nearest ally as yet known from India is *E. meyeni* (Carter), which is, however, more closely allied to *E. mülleri* Leberkühn. Weltner[1]), indeed, regards it as a variety of that species and is probably correct in so doing.

1) In: Arch. Naturg., 1895, Bd. 1, p. 123.